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The response of the guinea-pig ileum to electrical stimulation by coaxial electrodes. By W. D. M. Paton. *Department of Pharmacology (Royal College of Surgeons), Examination Hall, Queen Square, London, W.C.* 1

A length of guinea-pig ileum, suspended in oxygenated Krebs solution, is threaded on a platinum electrode. The lower end of the gut is tied on to glass tubing into which the electrode protrudes so that it can move freely up and down with the intestinal movements; the tubing can be used for connexion to a volume recorder. The upper end of the gut is tied securely to fine polythene tubing which encloses the upper part of the platinum wire from its emergence out of the intestine and up through the bath fluid. The platinum is thus insulated from the bath fluid, but is in electrical connexion with the lumen of the intestine. The platinum wire is made sufficiently long to be attached to a frontal writing lever for recording the intestinal movements. A second platinum electrode dipping into the Krebs solution makes the whole bath a diffuse external electrode.

The arrangement permits a fairly uniform excitation to be applied over the whole length of the intestine, even if it is contracting or relaxing, and ensures that all the stimulation current applied traverses the intestinal wall.

Single electrical shocks applied through the electrodes elicit brief twitches of the muscle, lasting about 1 sec, this *twitch response* in the undistended preparation has the following properties:

(1) Its threshold to stimulation with shocks of 0·5 msec duration is about 1 V, but 5–25 V are needed for a fully maximal response. The threshold is usually slightly lower if the lumen electrode is made positive.

(2) The twitch can be obtained with square pulses of 50 μsec duration; the 'chronaxie' is about 200 μsec.

(3) The twitch is abolished by small doses of atropine (10^{-8}), and is greatly augmented and prolonged by eserine 2×10^{-8}, or the anticholinesterase compound 284C51, 10^{-8}. It is insensitive to mepyramine, to desensitization to histamine or serotonin, or to concentrations of hexamethonium far in excess of those required to paralyse the peristaltic reflex. Procaine 10^{-5} reduces the twitch response.

It is concluded from the character of the strength-duration curve and from the pharmacological responses that postganglionic nerve fibres are being excited, and that there is no evidence for any other than cholinergic activity at their endings.

If the intestine is distended at a pressure of $1\frac{1}{2}$–3 cm H_2O, the twitch response becomes irregular in its behaviour, but an *emptying reaction* can now

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be demonstrated in response to single shocks. This resembles the peristaltic reflex, and is sensitive to ganglion-blocking agents.

If the 'emptying' and 'twitch' reactions are abolished by atropine or similar drugs, shortening and emptying of the preparation can usually still be achieved by considerably lengthening the duration of the shock or by repetitive stimulation, and the 'chronaxie' is now about 80 msec.

It appears possible, therefore, by this type of excitation to elicit, and distinguish, in a single preparation, excitation of preganglionic, postganglionic and effector cell structures.